HR001119S0030
Competency-Aware Machine Learning (CAML)
Frequently Asked Questions (FAQs)
as of 4/9/19

25Q: Will the government provide onboard computing facilities on which we can run our software, such as a GPU cluster with ample memory for data, or alternative offboard facilities with fast wireless connectivity?

25A: The Government will not provide facilities and/or computational resources for Phase I. Phase II work will be performed on Government-provided platform(s) and will require the integration of the developed software with the provided platform. If performer's solution requires special hardware, the performer should indicate it in the proposal. The Government will work with performers during the finalization of Phase II plans to facilitate integration or to ensure that the necessary resources are available.

24Q: In Phase II, do teams need to apply their CAML solution to multiple base ML application systems? Or only to the base ML application that we've worked with in Phase I?

24A: In Phase II, performers will apply their CAML solution to, likely, a single ML application that will not be the same as the work demonstrated in Phase I. However, the Phase II application will be related to the Phase I work to make the transition reasonable for performers.

23Q: Will the meta-knowledge and task strategies be evaluated separately (from overall task competency) for coverage, correctness, fidelity, reliability?

23A: The metrics will be evaluated separately. Specifically, *coverage* is related to TA1 (experiences and meta-knowledge), *correctness* is related to TA2 (task strategies), and *fidelity and reliability* are related to TA3 and TA4 (competency statements and consistent behaviors).

22Q: Do all concepts/rules have to be learned from experience? Can the CAML system start with background knowledge?

22A: The CAML system should identify unforeseen experience elements that with determine affect task strategies (termed meta-knowledge) developed during task learning, which cannot be pre-programmed into the system. However, it is within the scope of the CAML program for the base AI to have pre-programed behaviors that the CAML system may identify.

The CAML system should identify experience elements that determine task strategies, which cannot be pre-programed. However, the base AI may have pre-programed behaviors.

21Q: Can humans/users provide (corrective) feedback on the competency statements?

21A: Evaluations of the CAML system in both Phase I and II will be done with the CAML derived competency statements without any user feedback. However, enabling the CAML system to receive user feedback maybe helpful for training purposes and is within the scope of the program.

20Q: What is the budget limit for this program or do you have a budget expectation for, e.g., the first 36 months?

20A: Per Section II.A The level of funding for individual awards made under this BAA will depend on the quality of the proposals received and the availability of funds. Awards will be made to proposers whose proposals are determined to be the most advantageous to the Government, all evaluation factors considered.

19Q: Are National Labs eligible to submit to the BAA?

19A: Per Section III.A.1.b Government entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority and contractual authority, if relevant, establishing their ability to propose to Government solicitations. This information is required for Government Entities proposing to be awardees or subawardees.

18Q: We read in the announcement that the types of award that would be issued are procurement contracts, cooperative agreements or other transactions. We are a FFRDC organization under DOE and was wondering if an inter-agency agreement (IAA) under Form 7600 A or B is a possible award mechanism?

18A: Per Section III.A.1.b Government entities must clearly demonstrate that the work is not otherwise available from the private sector and provide written documentation citing the specific statutory authority and contractual authority, if relevant, establishing their ability to propose to Government solicitations. This information is required for Government Entities proposing to be awardees or subawardees. Depending on eligibility, the Contracting Officer will decide on what is the appropriate mechanism for award.

----------▲▲▲New Q/A▲▲▲----------

17Q: Section 8 of Attachment D Proposal Template Volume 1: Technical and Management states, “Provide a detailed task breakdown by calendar year,…” Could you confirm you truly want a detailed task breakdown by calendar year, not by Government fiscal year.

17A: Task should be brokendown by Contractor FY to align with cost breakdown.

16Q: CAML notes that cost or pricing data shall be required if the proposer is seeking a procurement contract per the referenced threshold, but FAR 15.403-1 indicates that certified cost or pricing data is not required: if prices are based on adequate price competition; when prices are set by law or regulation; when a commercial item is being acquired; when a waiver has been granted or when modifying a contract/sub-contract for commercial items. Since BAA HR001119S0030 is a competitive solicitation, can you please advise whether certified cost or pricing data (TINA) is required for a proposal submitted under this effort?

16A: Certified cost or pricing data will be required if the Contracting Officer selects a procurement contract as the award instrument for a selected research effort and the contract exceeds $2 million.

15Q: If we propose to demonstrate our CAML system on a platform that is not one designated by the program, should we include the chosen platform integrator on our team upfront?

15A: The CAML BAA does not designate a platform for the CAML system. For Phase I, demonstrations will be performed on a performer-provided machine learning system. Proposers should discuss the type of machine learning system that will be used and the architecture/mechanisms which will allow it to have competency awareness. Please designate an integrator if required. Phase II demonstrations will use government-provided platforms and therefore no integrator needs to be designated.

14Q: In the demonstration phase, would we have access to source code of the desired platform and be able to replace or modify parameters of internal components, or would we be asked to build a wrapper around the Government platform?

14A: For Phase I, demonstrations will be performed on a performer-provided machine learning system and therefore it is anticipated, but not required, that the CAML system will have full access to the base machine learning system internals. Proposers should discuss the type of machine learning system that will be used and the architecture/mechanisms which will allow it to have competency awareness. Phase II demonstrations will use government-provided platforms and the government team will work with performer teams to enable the CAML and base machine learning systems to interface. Proposers should design their competency modeling to facilitate such integration. CAML does not anticipate that performers will be able to replace or modify components of the core government-provided machine learning system.

13Q: Is the CAML system allowed to modify the behavior of the base machine learning system based on past experience? For instance, if a self-driving truck gets bogged down 95% of the time when it drives on sand, can the CAML system recommend it not drive on sand without prior human approval?

13A: CAML anticipates that prior to task execution, the competency-aware system will communicate its competency, via a competency statement, to a human user. It is up to the proposers to decide which competency statements will be communicated, these could include recommendations of alternative actions that would improve competency. CAML anticipates that it will be at the discretion of the human user to determine if the machine learning system should execute its task under the given conditions.

12Q: Can the base machine learning system continue to learn from feedback in the environment or from the user while it is also learning its competencies, or should we imagine the base system as static after training, so that the competencies are not changing while we try to learn them?

12A: Continuous task learning is desired but not required for CAML system. The competency model, however, should update itself as new experience elements are encountered both during training and task execution.

11Q: Can the CAML system learn new strategies that are suited to new conditions and recommend that the base machine learning system should take them, when the CAML system detects one of the new conditions?

11A: The goal of the CAML system is, as the name implies, to have a competency-aware machine learning system. By that we anticipate that the system can state its competency, along with a reason(s), for given tasks. Additionally, we anticipate the CAML system will be able to state competency under different conditions (e.g., the CAML system could provide ROC curves for different conditions, as mentioned in the BAA). Continuous task learning is desired but not required. Although proposers can choose to create a learning system that create improved strategies for new conditions, CAML only requires that the competency models incrementally capture and characterize the experience elements.

10A: Is a “new experience” defined as something not encountered until execution time? Or could it be part of the training phase of the base machine learning system, and be called "new" because it wasn't an experience foreseen by the developers of the base machine learning system?

10A: New experiences elements, in CAML, are experiences which the machine learning system has not yet encountered either in the initial training stage or during prior task execution. This includes self-discovered emergent meta-knowledge elements that influence task behaviors and were not specified prior to training.

9Q: Is it within scope to design a base ML system so as to optimize the base system's ability to become competency-aware, or is it desired that the competency-awareness framework be applicable to off-the-shelf base ML systems without redesign?

9A: CAML does not have a preference between integrated competency-aware machine learning systems and competency-aware frameworks which can be applied to off-the-shelf base machine learning systems. Proposers should look for best designs that enable accurate competency assessments.

8Q: Is the base machine learning system a black box that CAML system will have access to only via inputs and outputs, or does the CAML system have access to the base machine learning system internals to learn what it's doing?

8A: CAML is interested in a complete machine learning system. For Phase I, demonstrations will be performed on a performer-provided machine learning system and therefore it is anticipated that the CAML system will have full access to the base machine learning system internals. Proposers should discuss the type of machine learning system that will be used and the architecture/mechanisms which will allow it to have competency awareness.

Phase II demonstrations will use government-provided platforms and the government team will work with performer teams to enable the CAML and base machine learning systems to interface.

7Q: To what extent can the CAML system count on getting user feedback on base machine learning system actions/behaviors, e.g. user feedback indicating whether the system has correctly accomplished its goal or not? How much user feedback can/does the CAML system get and how often?

7A: The CAML system should be trained alongside the base machine learning system and therefore should have the same knowledgebase as the machine learning system. During task execution, it is up to proposers to decide how the complete system should determine feedback from executed tasks.

6Q: Attachments reference HR001118S0030

6A: Yes, this is a typo. HR001119S0030 is correct.

5Q: BAA HR001119S0030 Attachment G, number 8 Publication of Grant Awards requests to "[Provide a 1-page explanation of the proposed effort as outlined in Section VI.B.10.]"

Please clarify:

(1) is this section required for procurement contract proposals (since it appears to be relevant to Grant Awards)?

(2) what "explanation" is required? BAA Section VI.B.10 is "Disclosure of Information and Compliance with Safeguarding Covered Defense Information Controls".

5A: This requirement under paragraph 8 of Attachment G should be disregarded because it applies only to grants and DARPA does not intend to award grants under this BAA.

4Q: I saw nothing in the CAML BAA web program regarding ownership of the concept *after* the DARPA contract. Where can I locate this information?

4A: Please refer to Section VI of the BAA titled Award Administration Information. Specifically, Section VI.B Administrative and National Policy Requirements, and Section VI.B.4 Intellectual Property.

3Q: Per the BAA "Proposers should discuss how their system design would facilitate integration into Government test platforms" As the BAA does not specify in detail the government test platform, it may be impossible to accurately describe the manner in which this integration would occur. Can we get some clarification on the government test platform?

3A: Please refer to Section I.E of the BAA TA4 description, specifically the first full paragraph on Page 9 in the BAA. "For planning purposes, proposers may use the autonomous ground resupply vehicles as the reference platform and **provide the ROM**

estimate of the development effort supporting all three demonstration vignettes discussed below. Proposers whose machine learning problems do not fit the autonomous vehicle platform may use an alternative platform from the examples discussed above or another DoD relevant platform as the reference platform."

2Q: Per the BAA "Proposals should discuss how the learning system would provide a semantic interpretation of the emergent meta-knowledge" Could we get a clarification of what semantic interpretation means in this context?

2A: In this context, "semantic interpretation" means that the emergent meta-knowledge derived from task strategy analysis should have a description that is understandable to the human user. As a hypothetic example, if an object recognition system persistently relies on a region of pixels around an object for its recognition and the region is associated with the object cast shadow, then the "semantic interpretation" should state that the task has a dependency on the "cast shadow", instead of a neighboring region of pixels. The exact forms of the descriptions are dependent on the meta-knowledge and user applications and should be decided by the performers.

1Q: Per the BAA "Competency statements should facilitate accurate human insight into machine system capabilities and enable machine systems to achieve self-maintenance of performance based on a human partner's expectations". What is the level of autonomy expected in the self-maintenance? Is each proposer expected to define how the human partner's expectations are communicated to the machine?

1A: In the CAML BAA, the machine is expected to report its performance to a human user; the machine is not expected to be able to improve its performance beyond its training. Yes, proposers should define how the human partner's expectations are communicated to the machine. Please refer to the scenarios described in TA4: Capability Demonstration for examples of self-maintenance and human partner expectation inputs expected for experimentations and demonstrations. Proposers should describe unique aspects of self-maintenance that their approaches may provide.